Investigating Dynamic Capabilities, Agility and Knowledge Management within EMNEs- Longitudinal Evidence from Europe

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Abstract

Purpose: This paper analyses the impact of dynamic capability (DC) of emerging market multinationals (EMNEs) on their firm technological performance by teasing out the concepts of agility and knowledge management (KM) through DC.

Design/methodology/approach: Evidence from this study is contextualised on EMNEs that operate in the UK, Germany and France. The investment in intangible assets through which EMNEs are able to develop their DC over the period 2005-2016, is examined and how this leads to increased firm technological performance, is investigated.

Findings: Results show that higher investments in DC allows EMNEs to be more agile and gain competencies through KM and thereby sustain competitiveness in the three leading European countries. This research also identifies which EMNE groupings show greater technological performance and how such EMNE groupings are able to translate dynamic capabilities into greater technological performance compared to others over time. In summary, the role of DC during of the global financial crisis was also examined, where they are required to be more agile.

Originality/value: This paper sheds light on a novel way and motivation of successful EMNEs in using developed host countries as a location for generating DC through agility and KM.

Keywords: Dynamic Capabilities, Agility, Knowledge Management, Emerging-country Multinational Enterprises (EMNEs), UK, Germany, France, Resource-based-theory

1. Introduction

In the latest global rankings for attracting foreign direct investment (FDI), the United Kingdom, Germany and France were ranked 3rd, 4th and 5th respectively (UNCTAD, 2017). The other developed countries in the EU and North America have traditionally made up the largest share of inward investors into the UK, Germany and France in terms of FDI stocks (Bundesbank, 2012). However, a more recent trend is that the share of FDI from emerging market multinational enterprises (EMNEs) into Europe and particularly into the UK, Germany and France has risen constantly over the last decade, although from a lower base. This important aspect has not been researched as much in the literature on foreign investment.

Thus, a major limitation of the existing literature in this area has been the focus on "North-North" FDI, focussing on inter-EU investment with the addition of US affiliates (Blonigen and Piger, 2014). Historically, this focus has been data driven, with pre-2000 data only including small amounts of FDI from EMNEs (and even then much of the firm level data that is required is missing). Apart from data limitations that can capture the heterogeneity of FDI flows, this has led to limitations from a conceptual perspective, in the sense that any analysis includes mostly FDI that is market seeking in its motives and driven by its firm-specific advantages. Incorporating FDI from emerging and developing countries into technologically advanced countries such as the UK, Germany and France are more likely to capture technology sourcing FDI, as well as market seeking FDI. This distinction is important when discerning any variation in performance across firm types (Driffield and Love, 2006; Rice, Liao, Galvin and Martin, 2015). Therefore, such analysis requires updating, in order to include investments from EMNEs and to trace the changes in performance across EMNEs over time (e.g. Trahms, Ndofor and Sirmon, 2013).

Further, the existing literature is rather static in showing which firms are, on average, more productive, rather than highlighting the important and relevant drivers of this superior productivity, such as dynamic capabilities (DC), agility and knowledge management (e.g. Schilke, 2014). This is particularly important in terms of the debates on the extent to which inward investment generates productivity growth, or the types of inward investment host countries should attract in order to generate post-crisis growth. For example, productivity growth can be generated through intangible asset accumulation or the need for firms to generate cash flow endogenously in order to finance productivity growth.

Building on the existing literature on the topic of EMNEs, knowledge management, DC and agility (see e.g. Bamel and Bamel, 2018; Dove, 1999; Chen, Duan, Edwards and Lehaney, 2006; Denford, 2013; Guo, Jasovska, Rammal, and Rose, 2018; Malik, 2004; Nielsen, 2006; Pérez- Bustamante, 1999; Taghizadeh, Rahman, Hossain, 2018; Williamson, 2016), this paper thus offers the following contributions. Firstly, we examine the DC, agility and knowledge management within EMNEs that operate in the UK, Germany and France before, during and after the recovery from the recent global financial crisis of 2008. Second, we contribute to the literature by investigating the impact of EMNE investments in DC (see e.g. Barreto, 2010; Helfat and Peteraf, 2003; 2011) on their technological performance over the period 2005 to 2016. Third, we further dig deeper to identify which EMNE country groups show greater technological performance and how such EMNE country groups are able to translate DC into greater technological performance compared to other country groups over time (Barreto, 2010; Rice et al, 2015). Lastly, our paper contributes by investigating how EMNEs with dynamic capabilities show greater agility and how EMNEs from certain groupings show greater agility as compared to others, over time.

The rest of the paper is structured as follows. First, we review the literature on DC, agility and knowledge management and derive our hypotheses through the lens of RBT and

deliberate learning investments. The next section explains our empirical research design and describes our data sample and variables. We then present and discuss our findings. This is followed by a conclusion where we discuss the implications of our findings with regards to advancing the literature on DC by emerging market firms in advanced European countries and outline limitations of this paper which may offer avenues for future research.

2. Literature Review and Hypothesis Development

In the face of relentless competition and uncertainties, firms are advised to constantly adapt, renew, re-configure and re-create their resources and capabilities to survive and prosper (Barney, 2001). In this context, the concept of DC has become a central research area in the strategy literature, including knowledge and innovation (Teece, 2006). Indeed, Teece et al.'s (1997) seminal work paved the way to numerous scholars from different research backgrounds to use different theoretical perspectives to explore the nature of DC. However, despite the popularity of the concept, the literature remains fragmented (see Ambrosini and Bowman, 2009). Notwithstanding this fragmentation, scholars concur that DC are 'higher order capabilities' that allow for collation, creation and dissemination of knowledge; continuous updating of operational processes; dynamic interaction with the environment and reflexivity in decision making (Easterby-Smith et al., 2009).

Although Teece et al's (1997) seminal paper on the DC highlights the work of Nelson and Winter (1982) on *Evolutionary Theory of Economic Change,* Pavlou and El Sawy (2006) suggest that the emergence of DC comes from "Schumpeterian competition" where competitive advantage is associated with the "creative destruction" of existing resources and "novel combination" of the resource based theory (RBT) (Barney, 2001; Metcalfe, 1998). Consistent with this view, DC are seen as originating from the RBT of the firm (Nielsen, 2006) and while RBT of the firm is mainly concerned with selecting and combining resources

(Ferreira and Fernandes, 2017), DC stresses renewing and reconfiguring existing resources (Karim, 2006). Seen through this lens, DC is an extension of the RBT and organisation performance is influenced by the "capacity" of a firm to accumulate, deploy, refresh and reconfigure resources and competencies to match alterations in the external environment (Teece et al, 1997; Eisenhardt and Martin, 2000; Pandza et al, 2003; Lee and Slater 2007; Griffith et al, 2006; Wilson and Daniel, 2006; Smart et al, 2007; Wang and Ahmed, 2007; Lee and Kelley, 2008; Rice et al, 2015).

Therefore, Helfat et al. (2007) assert that that reconfiguration of tangible and intangible assets is at the heart of the DC construct. They define DC as "the capacity of an organisation to purposefully create, extend, or modify its resource base.… The 'resource base' of an organisation includes tangible, intangible and human assets (or resources) as well as capabilities which the organisation owns, controls, or has access to on a preferential basis". Simply put, DC are the ability of the organisations to use their respective organisational processes to change the firm's resource base (see for instance: Penrose, 1959; Priem and Butler, 2001; Ambrosini and Bowman, 2009, p.5). In this context, Zollo and Winter (2002) posit that the role of DC, in essence, is to reconfigure firm specific intangible assets such as organisational knowledge over a period of time. Hence, the influence of deliberate learning investments, knowledge accumulation and articulation are central to DC contributing to the firm performance (Rice et al, 2015). They assert, "a dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness" (2002, p.340). Similarly, Bergman et al (2004) believe that learning and knowledge creation are fundamental to the generation of DC while Nielsen (2006, p.65) views DC as "concrete and well known knowledge management activities" of the firm where "the performance of a firm is dependent on the ability to exploit its integrated knowledge resources". In this paper, we concur with the

view that reconfiguration of intangible assets through deliberate learning investments (i.e. training and learning investments) and protection of intellectual property rights (Augier and Teece, 2007; Harreld et al, 2007) lead to greater firm performance.

While the RBT has been viewed an influential framework that accounts for performance differences across the firms based on firm specific assets (Barney, 1996; Wright et al, 1994; Grant, 1996; Peteraf and Barney, 2003; Wiklund and Shepherd, 2003; Beard and Sumner, 2004; Barney and Clark, 2007), the RBT fails to elaborate how reconfiguration of these resources over time can account for enhanced performance as a response to changes in the external market. In this respect, DC is viewed as an extension of the RBT that explains how reconfiguration of firm specific assets could lead to greater performance and competitive advantage (Teece et al, 1997; Zott, 2003; Janutnen et al, 2005; Zahra et al, 2006; Teece, 2007, 2012; Wang and Ahmed, 2007; Helfat and Peteraf, 2009, 2011; Wilden et al, 2013).

Nonetheless, while many previous research of the DC-performance has focused on theoretically advancing this relationship, very few studies have attempted to empirically assess the mediating role of dynamic capabilities on performance (Zahra et al, 2006; Ambrosini and Bowman, 2009; Arend and Bromiley, 2009; Giudici and Reinmoeller, 2012). Helfat et al (2007) allege that to understand the DC-performance relationship, it is imperative that one must assess how much value DC really creates. An organisation could gain advantage if its DC create higher value than competing firms (Helfat et al, 2007). This, however, by no means confirms that DC necessarily lead to superior performance. Similar to competitive advantage based on the RBT, there are several conditions to be met in order for DC to be considered the source of competitive advantage. The first condition is that the same DC must exhibit heterogeneity in the technical fitness (Helfat et al, 2007); secondly, the application of dynamic capabilities must be in demand since they only have value when in use and competitive advantage could only be generated when dynamic capabilities are applied. Finally, similar to VRIO resources, dynamic

capabilities must be rare simply because no competitive advantage could be generated if firms possess similar DC. Consistent with their view, assessing performance is a useful way to evaluate the value creation of DC relative to competitive advantage.

Helfat et al (2007) argue that performance differences across firms could be explained by differences across DC of competing firms. Other research on the DC-performance relationship have demonstrated the contribution of DC to firm performance and competitive advantage through asset reconfiguration. For instance, Harreld et al (2007) believe that IBM's remarkable transformation to success has been due to various reasons, but one of the main reasons has been their ability to identify and seize opportunities and to reconfigure the firm specific assets to achieve superior performance. Harreld et al (2007, p.41) conclude that: "sustained competitive advantage comes from the firm's ability to leverage and reconfigure its existing competencies and assets". Similarly, Wu (2007) in the study of entrepreneurial resources, dynamic capabilities and start-up performance of Taiwanese high tech companies evaluates the relationship between asset reconfiguration dynamic capabilities and performance. Wu's (2007) study evaluates the resources and performance of start-ups in a rapidly changing market. By using data from Taiwanese high tech companies, it investigates and demonstrates that DC were significantly helping to leverage entrepreneurial resources to benefit start-up performance, and illustrates that through asset reconfiguration, DC contributed towards firm's performance.

Other research has also argued how DC lead to greater performance over time (Zollo and Winter, 2002; Macher and Mowery, 2009; Drnevich and Kriauciunas, 2011; Prange and Verdier, 2011; Protogerou et al, 2012; Wilden et al, 2013; Lin and Wu, 2014; Teece, 2012, 2014 (a); Wang et al, 2015). Furthermore, recent studies have highlighted the significant role of DC in MNEs (Teece, 2012, 2014 (b); Vahlne and Ivarsson, 2014; Lessard et al, 2016) and asset seeking EMNEs (Parthasarathy et al, 2017). When MNEs extend their international

activities, their success is not only dependent on the portfolio of resources they possess but also on their ability to continuously modify their resource base (Li, 1998; Prange and Verider, 2011). In this vein as Teece (2007, 2009, 2012 and 2014) argues that DC are particularly relevant to studies of MNEs performance because such firms operate in fast changing global markets. Nonetheless, the examples of studies investigating the role of DC in EMNEs is very limited. In this paper, we strive to advance the current understanding of DC-performance relationship in EMNEs. More specifically, we show technological performance differences of EMNEs in Germany, France and UK before, during and in the post global financial crisis of 2008. The arguments above lead to the following hypothesis for our empirical work:

Hypothesis 1a: *The higher the investment in dynamic capabilities by EMNEs in developed countries, the greater the EMNE's technological performance over time.*

The extent to which EMNEs differ in their ability to perform with higher technological performance and translate investments in DC into higher performance in developed countries may also depend on where these EMNEs are coming from. The literature on firm internationalisation has in detail outlined the need for MNEs to overcome the 'liability of foreignness' in markets abroad where the business environment is different from the one at home (Dunning, 1988). However, this inherent 'cost of doing business' abroad is shown to differ on a number of characteristics. In general, the narrower the gap between the source country characteristics and the host country characteristics the smaller the liability of foreignness and the effort required on the part of the MNE to adopt its activities to the host country setting. For example, the same language, similarity of the legal system, institutional structures and business practices will lower the 'liability of foreignness' of FDI between such countries and enhance the chances of success in the foreign investment.

This literature also emphasises the concept of 'psychic distance' (Johannson and Vahlne, 1977) whereby MNEs are aware of their differences between where they come from and the various options in locating their foreign investments. This realisation is argued to lead MNEs to initially invest in foreign countries where the 'psychic distance' is lower. However, as their international business experience increases the MNE is able to progressively target foreign markets with higher levels of 'psychic distance' (Chikhouni, Edwards and Farashahi, 2017).

In this regard, we follow the literature in arguing that certain EMNEs have closer ties with each host country, which are due to cultural, historical or institutional similarities (Bae and Salomon, 2010; Ramamurti, 2008; Marchand, 2017; Munjal and Pereira, 2015). There is empirical evidence that shows that, for example, Commonwealth member countries are inclined to do better in their investments in the UK (e.g. Lundan and Jones, 2002). A similar argument can be made about the historical ties that exist between France and its ex-colonies which to varying levels have kept language, legal, education and other institutional structures that resemble that of France (Head, Mayer and Ries, 2010; Grier, 1999; Mayer, Méjean and Nefussi, 2010). In regard to Germany, Eastern Europe has always had closer links, certainly with Eastern Germany prior to re-unification in 1989 and the proximity of Eastern Europe to Germany (Brenton, Di Mauro and Lücke, 1999; Marin, Lorentowicz and Raubold, 2003; Petrakos, 2013). This familiarity of the business environment by EMNEs with closer cultural, historical and institutional similarities leads to the argument that such EMNEs are in a better position to convert DC into higher technological performance. This leads to the following two hypotheses:

Hypothesis 1b: *EMNEs from similar cultural, historical or institutional contexts as the host country show greater technological performance over time compared to EMNEs that are less similar compared to the host country.*

Hypothesis 1c: *EMNEs from similar cultural, historical or institutional contexts as the host country are able to translate dynamic capabilities into greater technological performance over time compared to EMNEs that are less similar compared to the host country.*

Although the concept of strategic agility was introduced about two decades ago, it is only recently, particularly in the backdrop of financial crisis and subsequent socio-political, technological and economic uncertainties, that it has attracted renewed interest from academic scholars (Adler et al., 1999; Grewal & Tansuhaj, 2001; Judge & Miller, 1991; Tallon and Pinsonneault, 2011; Weber and Tarba, 2014). Organisational agility is often conceptualised as the "ability to remain flexible in facing new developments, to continuously adjust the company's strategic direction, and to develop innovative ways to create value" (Weber and Tarba, 2014). Other organizational theorists have associated organisational agility to its ability to remain flexible and adaptable in the face of changing internal and external circumstances (Worley et al, 2014; Teece et al., 2016). Although uncertainty has always been a feature of business environment, highly advanced and integrated global economy means the external shocks have become more frequent and the implications are not well predictable. Thus, organisations possessing strategic agility should have the ability to change the course of its actions more frequently and more effectively. Agile organisations, according to Weber and Tarba (2014:13) those that "have the ability to initiate continuous renewal that includes adapting existing competencies to an ever-changing environment and simultaneously reconfiguring themselves in order to survive and thrive for the long term". In other words, firms that successfully cope with strategic discontinuities and disruptions are the ones, which possess amongst others high level of organizational flexibility and processes to capture, integrate and produce knowledge.

As previously noted, one of the key arguments underpinning dynamic capabilities is that they positively influence organisational performance (Zollo and Winter, 2002; Macher and

Mowery, 2009; Drnevich and Kriauciunas, 2011; Prange and Verdier, 2011; Protogerou et al, 2012; Wilden et al, 2013; Lin and Wu, 2014; Wang et al, 2015). They also create conditions for firms to thrive by responding to change and uncertainty from the external environment (Teece et al, 1997; Eisenhardt and Martin, 2000; Pandza et al, 2003; Lee and Slater 2007; Griffith et al, 2006; Wilson and Daniel, 2006; Smart et al, 2007; Wang and Ahmed, 2007; Lee and Kelley, 2008). During crises, many underlying forces in the industry could change at a rapid pace and dynamic capabilities are key to superior performance in fast changing industries (Teece et al, 1997; Teece, 2014a, Pezeshkan et al, 2016). In fact, research has suggested that dynamic capabilities are more applicable and in demand during regimes of rapid change such as financial crisis (Newey and Zahra, 2009; Ambrosini et al, 2009). However, although previous studies have suggested that dynamic capabilities afford an organisation the ability to achieve congruence with the external environment (Fainshmidt et al., 2017), examples of empirical studies of dynamic capabilities during crises are rare[1].

Given the tripartite micro-foundations (sensing, seizing, reconfiguring) of dynamic capabilities focusing on the ability of the firm to reconfigure their resource base in response to external challenges, therefore the application of dynamic capabilities is particular relevant to studies and actions of firm performance during crisis. It is in this backdrop that Teece et al., (2016) have attempted to present the relationship between dynamic capabilities and organisational agility. In doing so, they aim to bring on board the role of managerial cognition and decision making by CEOs and senior managers, who at a critical juncture have to make sense of key developments and delineate the response of the firm. Thus, they conceptualise

[1] More recently, some studies have focused on the role of dynamic capabilities during crises. For instance, Nair et al (2013) found that Enterprise Risk Management (ERM) as a dynamic capability allowed firms to respond more effectively to the financial crisis of 2008. Similarly, Makkonen et al (2014) found that dynamic capabilities allowed firms to perform better during the 2008 financial crisis.

organisational agility as a distinct dynamic capability that helps a firm manage environmental uncertainties.

Nonetheless, no study has investigated the effectiveness of EMNEs' dynamic capabilities and in that respect, organisational agility during crisis and consequently, our second hypothesis is formulated as follow:

Hypothesis 2a: *EMNEs with higher dynamic capabilities show greater agility over time.*

Hypothesis 2b: *EMNEs from similar cultural, historical or institutional contexts as the host country show greater agility over time as compared to EMNEs that are less similar compared to the host country.*

3. Research Design

The data for our analysis is drawn from *ORBIS*, which is a commercially available database of annual accounts. A unique feature of the data set is the identification of foreign-owned firms, where the nationality of a firm is determined by the ultimate owner's country of ownership (see Temouri et al, 2008 or Geishecker et al, 2009 for a more detailed discussion of ORBIS[2]). We include firms for which we have information on our key variables, such as the factor inputs to estimate firm performance as total factor productivity (TFP). We have a panel of firms over the period 2005-2016 across the manufacturing sector and services sector. All variable definitions and summary statistics are presented in the appendix, where we also offer a matrix of correlations for all our variables used in the analysis.[3]

[2] For a discussion comparing such data with other data sources, see Ribeiro et al. (2010).
[3] The Orbis dataset will list small firms. However, we had to exclude these as they do not report all the variables needed in our analysis. In Germany, small firms of up to 10 employees or total assets of up to 350,000 euros or annual revenues of 700,000 euros are exempted from full accounts disclosure and may report limited financial statements.

Table 1 shows the distribution of EMNEs across Germany, France and the UK and the regions of foreign ownership. The share of EMNEs in the UK is the largest with 1,669 firms, followed by France (1,340) and Germany (1,119). EMNEs from BRICS countries represent the largest number of firms in Germany and France, with the exception of EMNEs from Commonwealth countries in the UK. The number of EMNEs for Eastern and Central Europe is largest in Germany and EMNEs from former French colonies are mostly concentrated in France, as expected. Countries which we have not grouped for our analysis are captured by countries labelled 'Rest of emerging countries'.

[Insert Table 1]

Estimation technique

In estimating firm performance, we rely on firm level total factor productivity (TFP) which is an economic concept and essentially measures technological or efficiency improvements of firms not attributable to traditional inputs such as labour and capital used in production. In order to measure a firm's TFP, an estimate of TFP can be obtained from a production function as follows:

$$y_{it} = \alpha_0 + \alpha_k k_{it} + \alpha_l l_{it} + \alpha_m m_{it} + \varepsilon_{it}, \qquad (1)$$

where *y* is the output of a firm, and *k*, *l*, and *m* are three typical inputs, namely capital, labour, and material, respectively. The residual $\hat{\varepsilon}_{it}$ from (1) is interpreted as TFP. Estimating this equation using Ordinary Least Squares (OLS) is likely to lead to biased and inconsistent estimates of TFP. The reason is that when estimating unobserved productivity as the residual of the production function at the firm-level, one encounters the problem of endogeneity. The endogeneity problem occurs when at least a part of the TFP is unobserved by the econometrician but observed by the firm at a time early enough so as to change the factor input

decision. If that is the case, then profit maximization implies that the realization of the error term is expected to influence the decision on factor inputs. In other words, the regressors and the error term are correlated, which makes OLS estimation biased and inconsistent. The remedies to control for endogeneity include, among others, the Levinsohn and Petrin (2003) approach by using material inputs as a proxy to control for unobservable productivity shocks. The full description of the LP estimation method and algorithm is beyond the scope of this paper. Readers interested in more detail are referred to the original work by Levinsohn and Petrin (2003) which is a popular approach in the literature to deal with the endogeneity of inputs (e.g. Smarzynska Javorcik 2004; Griffith et al. 2006). Having controlled for endogeneity in inputs using this approach, we use this estimate of TFP as a dependent variable to estimate the following main equation:

$$TFP_{it} = \alpha + \beta_1 Intangibles_{ijt} + \beta_2 EMNE + \beta_3 EMNE * Intangibles_{ijt} + \beta_4 Controls_{it} + \lambda_j + \mu_t + \varepsilon_{it} \quad (2)$$

where subscripts i, j and t refer to firm, year and industry respectively and ε_{it} represents the error term. With regards to the main independent variables, the key variable is intangible assets. We have used both the level of intangible assets and the annual change in intangible assets in testing for technological performance in the analysis. Since our findings were consistent with both levels and annual change in intangible assets we decided to illustrate the findings for levels only. The focus on intangible assets, builds on the wider literature that seeks to empirically investigate the role and contribution of intangible investment on the growth of the 'knowledge economy' (Corrado et al., 2013). Intangible assets are also used in work seeking to operationalise ideas around knowledge capital or firm specific assets (Blonigen et al., 2003). The relationship between intangible assets and productivity therefore illustrates how locally generated knowledge or technology is translated into productivity growth. For example, the standard analysis of the MNE assumes that, apart from resource seeking, there are essentially two motives for a firm entering a given location. Knowledge exploiting, where the

firm seeks to exploit knowledge or technology generated within the parent company in a new location, or knowledge sourcing, where the MNE seeks to invest in a location in order to acquire knowledge in a given location. Indeed, Driffield and Love (2006) demonstrate the importance of this distinction in terms of the likely social returns to that investment, and also, for the UK, demonstrate how this differs by country of ownership (Driffield and Love, 2005). However, while the data for both of these studies is for the UK, and analysed at the aggregate level, it does highlight the key distinction between what is essentially transatlantic investment, and investment into Europe from the emerging economies.

The typical approach to estimating (2) – see Temouri et al. (2008) for a discussion of this literature, is to estimate this with a set of ownership dummies to capture the heterogeneity of EMNEs and determine the ordering in terms of productivity. Our focus, however, is to estimate this model for each group separately to examine differences in the drivers of productivity across the different groups of firms in Germany, France and the UK. The rationale for doing this is to provide information on the drivers of productivity growth within the German, French and UK economy for the pre-crisis, crisis and recovery period. The focus is on the comparison of the determinants of productivity growth, and in particular the interactions between the drivers of productivity growth and ownership type.[4]

We start with the three groups of EMNEs point, contrasting the relative importance of DC to drive productivity growth. This builds on the literature that follows Hansen (2000) in linking internal resources to productivity growth.[5] A positive relationship between DC and

[4] The result of estimating the three countries together does not drastically change the overall message that there is significant heterogeneity of EMNEs depending on where there are from. However, it is really the estimation for each country separately that draws our attention to differences which are country-specific such that certain EMNEs tend to translate DC into higher technological performance compared to others.
[5] For a wider discussion of this literature see Corricelli et al. (2012).

productivity suggests that knowledge capital is generating productivity growth at the firm level. These effects are expected to vary across country/region of ownership.

A similar pattern is expected across country of ownership, with firms from more technologically advanced EMNE countries are more reliant on intangible assets to generate productivity growth than firms from emerging and developing countries, who are more likely to focus on cash flow. This is consistent with the analysis of outward FDI by emerging market firms, which is driven by cash flow generated at home, and the desire to access global technology (Ramamurti, 2012). We divide the source countries of EMNEs into five region categories: (a) BRICS, (b) MINT (c) Eastern Europe (d) French colonies and (e) Commonwealth.

We subsequently add another dimension to capture the crisis periods, namely the pre-crisis period (2005-07), the crisis period (2008-12) and then the post crisis period (2012-16). The focus here is to link what impact DC development has on it before the global financial crisis (2005-07), during the global financial crisis (2008-2012) and also immediately after the global financial crisis (2013-2016). We utilise TFP as our dependent variable in linking what impact DC development has on it before the global financial crisis (2005-07), during the global financial crisis (2008-2012) and also immediately after the global financial crisis (2013-2016).

Finally, we also control for both firm size and age and industry affiliation. Firm age is measured in years and firm size is proxied by the number of employees in each EMNE. We further have included one year lags on the independent variables to reduce potential endogeneity.

4. Findings and Discussion

Table 2 reports the results of equation (3) for Germany, followed by results for France and the UK in tables 3 and 4, respectively. All specifications are estimated separately for the before-, during- and post-crisis period, in order to uncover potential differences in the impact of DC on technological performance across firm types. In terms of estimation, we show whether a specific group of EMNEs is different in their impact of DC on technological performance compared with the other country groups of EMNEs. This allows us to have the other groups as the reference category.

Our first main result offers evidence in support of hypothesis 1a and 2a. More specifically, the coefficients on DC are all positive and statistically significant. This means that the higher the investment in dynamic capabilities by EMNEs in the three developed countries, the greater the EMNEs technological performance in general (i.e. H1a) as well as over the three phases (i.e. H2a). Thus, evidence from our study demonstrates that the investment in organisational knowledge and learning have resulted in DC which in turn contributes to greater technological performance (Bergman 2004; Nelson 2006; Zollo and Winter, 2002).

Having established a clear link between DC investments and greater technological performance, we now test hypothesis 1b by identifying certain groupings of the EMNEs that show greater technological performance as compared to other EMNEs over the three phases. This can be seen in the second row of each table for Germany, France and the UK. For Germany, the coefficients for BRICS and MINT EMNEs are positive and statistically significant before the crisis, but are only positive for MINT during the crisis period, whereas both for BRICS and MINT, they show no discernible difference in the post crisis period. In terms of Central and Eastern Europe, we consistently find a lower tech performance throughout

the three phases. This offers some evidence for the nature of the firms from Central and Eastern Europe who perform less well even though they enjoy geographical and cultural proximity.

For France, both EMNEs from BRICS and former French colonies are less technologically advanced than other EMNEs which is consistent throughout the three phases. For the UK, EMNEs from BRICS more technologically advanced (during and post crisis period) whereas EMNEs from the Commonwealth show no discernible difference in terms of their performance, which again is consistently observed throughout the three phases. The group of EMNEs from MINT countries are no different in their technological performance as compared with the other EMNEs in the case of France and the UK. This offers some supporting evidence to hypothesis 1b, which states that EMNEs from certain groupings show greater technological performance compared to others over time.

With regards to our evidence for testing hypothesis 1c, this is shown in the third row of each table. In Germany, EMNEs from Central and Eastern Europe show consistently positive and statistically significant coefficients, which means that they are able to translate dynamic capabilities into greater technological performance as compared to others over the three phases. We attribute this to the fact that they operate from a lower technological base as compared to others (shown in row 2), which means that they utilise learning and experience in becoming more efficient. At the same time, EMNEs from BRICS show no discernible difference in translating DC into higher tech performance, which could be due to the nature and level of their industry affiliation and technological background. However, it is interesting to uncover negative and statistically significant coefficient for EMNEs from MINT countries before and during the crisis. It seems that their ability to translate DC into higher tech performance is least successful in the period before and during crises, but this is alleviated in the post crisis period, where they show similar ability as compared to other EMNEs.

Agility as a concept is evident during the periods of deep uncertainty, such as the global financial crisis. Our evidence isolates this in phase 2 and therefore tests hypothesis 2b. According to our results, we find that the EMNEs from BRICS countries are the ones which show greater agility in respect to their operations in France, whereas EMNEs from Central and Eastern are more agile in their operations in Germany. The reason for this is confirmed by the extant literature which suggests that EMNEs from BRICS are more experienced in their international operations. However, in the face of higher uncertainty in the UK the EMNEs from the commonwealth show less agility which highlights perhaps the limited entrepreneurial management capabilities of these EMNEs. This is despite the fact that EMNEs from the Commonwealth have strong historical and cultural proximity to the UK. One of the reasons for their limited agility could be that the EMNEs from the Commonwealth are very much heterogeneous in nature and background, which subsequently mitigates the positive impact that actually comes from a few leading countries, such as India and Nigeria. Similarly, the results for the French colonies shows a negative coefficient throughout the three phases. Again, this seems to suggest that historical and cultural proximity are not sufficient reasons that can substitute for greater levels of agility. In other words, historical and cultural proximity may reduce an EMNEs liability of foreignness which the literature has unambiguously shown, but our study suggests that this does not necessarily correlate with the ability and agility to translate DC into greater technology performance.

[Insert Table 2, 3 and 4]

In summary, our findings convey two general trends in terms of EMNE operations in the UK, Germany and France. Firstly, investments by EMNEs in organisational knowledge and learning lead to DC which in turn contribute to greater technological performance. Therefore, the subset of EMNEs that are able to maintain their deliberate investments in intangible assets are the ones that are growing the fastest in terms of their technological performance which is

necessary to compete with their rivals in such advanced developed countries. Secondly, our findings have uncovered significant differences in EMNE country groupings. In particular, the technological performance and the ability to be agile is different across EMNEs origin country groupings and at different time periods (i.e. pre-, during- and post-crisis). The reasons could be due to the historical and cultural proximity, as well as EMNE experience in the respective European countries.

5. Conclusions

This paper contributes to the EMNE literature by exploring for the first time the relationship between DC, agility and technological firm performance and observing variation in technological performance of EMNEs over three distinct time phases. We conceptualise technological performance in our paper as an output of a firm's capacity in integrating knowledge and processes. As our study is exploratory in nature, we provide a number of valuable insights through our empirical study for EMNEs that operate in advanced countries.

Our first finding is that DC impacts positively on technological firm performance in EMNEs that operate in Europe, with evidence from UK, Germany and France. The implications of this result for the senior managers of EMNEs is, the strategic decision to internationalise to advanced developed economies should be coupled with deliberate learning investments at the organizational level in order attain and maintain technological performance.

Further, our study was deliberately designed longitudinally to capture the relationship between DC and tech performance over three different and important phases in order better capture and isolate the extent of agility demonstrated by EMNEs. This paper further contributes by investigating EMNEs' technological performance and ability to be agile in three different European countries over the same period of time. Our results show that not all EMNEs are similar in their capacity to be agile at different phases and different countries. This could be

due to the country background, historical and cultural proximity, as well as experience that the EMNEs had in the respective European countries.

The implications for EMNE managers is that they cannot purely rely on historical and cultural connections to the host country to be successful in tech performance, particularly in different phases of uncertainty. Instead, our findings suggest that the reliance on and investment in DC would be much more fruitful to gain better tech performance.

[Insert Figure 1 here]

Theoretically, our paper also contributes to the ongoing debate in the literature. We observe that the literature on DC has two broad schools of thought. The first school of thought has emerged from the works of Nelson and Winter's (1982) *The Evolutionary Theory of Economic Change*, which was adopted by Zollo and Winter (2002) to argue that DC develops from repetitive routines. Routines are facilitated by deliberate learning investments and firms that make such learning investments, perform better. The second school of thought builds on the RBT and argues that DC results from a firm's capacity to reconfigure organisational resources, thus further improving existing resource configuration (Teece et al., 1997; Eisenhardt and Martin, 2000). Teece et al. (2016) further builds on this perspective and argues that organisational agility is a DC in itself, which firms adopt in the times of deep uncertainties.

In our research, we note that in the pre-crisis period, the greater technological performance of EMNEs across different advanced European countries could be explained as a result of adaption of deliberate learning investments by these firms. However, in the crisis period we observe that DC are predominantly about taking agile decisions to adapt to changing environments. Thus, in our study we observe the two perspective on DC in action. In stable environments (pre-crisis) the routine perspective takes precedent whereas in in a crisis environment the agility perspective is more prominent. We would argue that the two

perspective are to a certain extent complimentary and not exclusive (See Figure 1). Our study is not without limitations and we would like to highlight three main ones. Firstly, we endeavoured to measure DC with the help of intangible assets, but future research may be able to use a finer grained analysis in terms of other ways of measuring DC. Secondly, we merely uncovered some differences across EMNE groupings, but much more research is needed to try and find out empirically and conceptually the reasons why certain country groupings are different in terms of their technological performance (this could perhaps be more fruitful with qualitative research methods). Lastly, future research should investigate and shed more light on the complimentary nature of the two perspectives on DC as described above.

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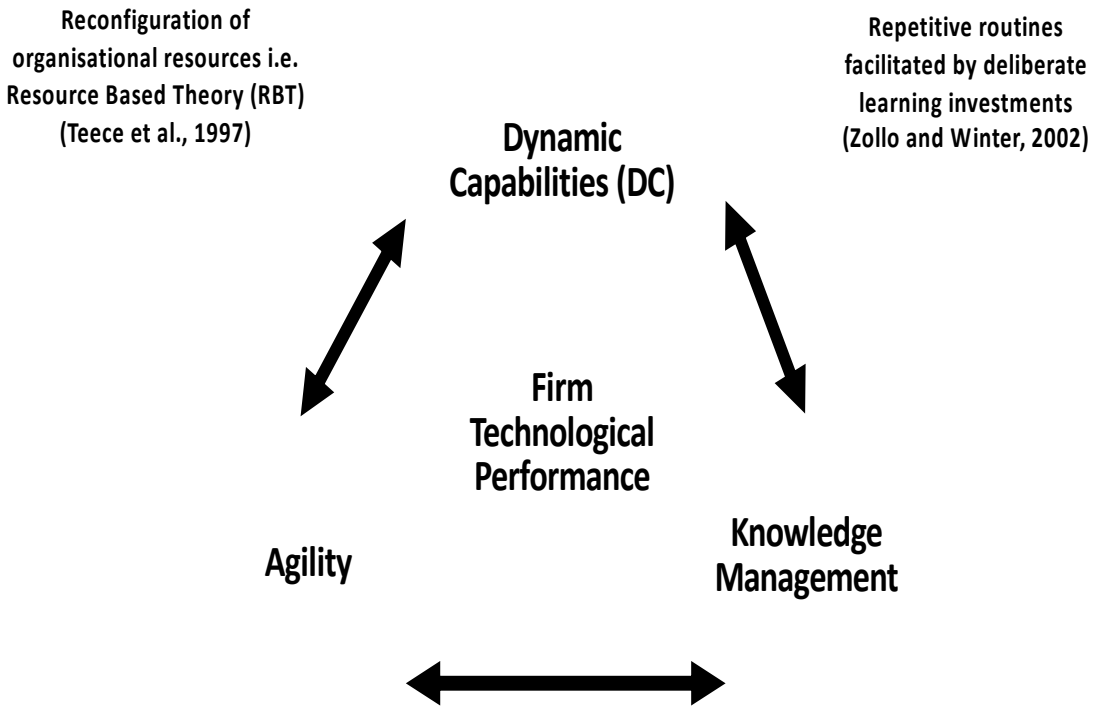

Figure 1: Theoretical model developed based on authors proposed contribution

Table 1 Distribution of EMNEs in Germany, France and the UK (2005-2016)

	Germany	France	UK
BRICS	336	351	353
MINT	48	72	48
Eastern and Central Europe	180	62	61
French colonies	9	251	27
Commonwealth	197	226	667
Rest of emerging markets	349	378	513
Total Number of Firms	1,119	1,340	1,669

Source: Authors' calculations from the ORBIS dataset.

Table 2: Impact of Dynamic Capabilities on Knowledge Management in Germany

	Before Crisis (2005-2007)			During Crisis (2008-2012)			Post Crisis (2013-2016)		
	BRICS	MINT	Eastern Europe	BRICS	MINT	Eastern Europe	BRICS	MINT	Eastern Europe
Dependent variable: log TFP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
log Intangible assets	0.0386***	0.0349***	0.0258***	0.0375***	0.0349***	0.0272***	0.0193***	0.0189***	0.0173***
	(0.00732)	(0.00632)	(0.00671)	(0.00544)	(0.00468)	(0.00496)	(0.00556)	(0.00478)	(0.00513)
Group	0.126**	0.612**	-0.246***	0.103**	0.637***	-0.223***	0.0106	-0.0927	-0.0712
	(0.0591)	(0.292)	(0.0640)	(0.0435)	(0.240)	(0.0485)	(0.0432)	(0.334)	(0.0486)
Group*Intangible assets	-0.0169	-0.117**	0.0304**	-0.0112	-0.109***	0.0339***	-0.000353	0.0611	0.00970
	(0.0105)	(0.0461)	(0.0132)	(0.00774)	(0.0386)	(0.0101)	(0.00779)	(0.0583)	(0.0102)
Firm size	0.0281**	0.0280**	0.0269**	0.0213**	0.0221**	0.0194**	0.0353***	0.0352***	0.0343***
	(0.0114)	(0.0114)	(0.0114)	(0.00865)	(0.00864)	(0.00865)	(0.00983)	(0.00983)	(0.00990)
Firm age	0.0807***	0.0804***	0.0756***	0.0892***	0.0889***	0.0840***	0.0744***	0.0753***	0.0722***
	(0.0119)	(0.0119)	(0.0120)	(0.00986)	(0.00988)	(0.00994)	(0.0136)	(0.0136)	(0.0137)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.433***	4.484***	4.612***	4.933***	4.933***	4.744***	3.170***	3.177***	3.202***
	(0.469)	(0.468)	(0.470)	(0.356)	(0.356)	(0.357)	(0.394)	(0.393)	(0.393)
Observations	2,787	2,787	2,787	4,645	4,645	4,645	3,716	3,716	3,716
F-statistic	15.20	15.25	15.43	26.45	26.51	26.76	20.37	20.41	20.41
Prob > F stat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.269	0.270	0.272	0.276	0.277	0.278	0.263	0.270	0.270

Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively. Robust standard errors are in parentheses.

Table 3: Impact of Dynamic Capabilities on Knowledge Management in France

	Before Crisis (2005-2007)			During Crisis (2008-2012)			Post Crisis (2013-2016)		
	BRICS	MINT	French Colonies	BRICS	MINT	French Colonies	BRICS	MINT	French Colonies
Dependent variable: log TFP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
log Intangible assets	0.0398***	0.0468***	0.0563***	0.0308***	0.0390***	0.0464***	0.0265***	0.0369***	0.0407***
	(0.0067)	(0.00564)	(0.00612)	(0.00503)	(0.00418)	(0.00452)	(0.00539)	(0.00441)	(0.00473)
Group	-0.0888*	0.123	-0.0780	-0.0883**	0.158	-0.111***	-0.0202	-0.170	-0.194***
	(0.0538)	(0.387)	(0.0528)	(0.0398)	(0.294)	(0.0400)	(0.0429)	(0.272)	(0.0442)
Group*Intangible assets	0.0192*	-0.0480	-0.0370***	0.0218***	-0.0435	-0.0209**	0.0226***	-0.00588	-0.00355
	(0.0103)	(0.0583)	(0.0119)	(0.00748)	(0.0419)	(0.00882)	(0.00801)	(0.0460)	(0.00970)
Firm size	0.186***	0.185***	0.170***	0.201***	0.199***	0.186***	0.212***	0.213***	0.199***
	(0.0109)	(0.0109)	(0.0111)	(0.00821)	(0.00818)	(0.00838)	(0.00897)	(0.00895)	(0.00918)
Firm age	0.0574***	0.0572***	0.0582***	0.0569***	0.0568***	0.0584***	0.0695***	0.0691***	0.0707***
	(0.0111)	(0.0111)	(0.0110)	(0.00927)	(0.00928)	(0.00925)	(0.0130)	(0.0130)	(0.0130)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.644***	3.626***	3.649***	3.644***	3.620***	3.639***	3.544***	3.529***	3.558***
	(0.199)	(0.199)	(0.198)	(0.153)	(0.153)	(0.153)	(0.173)	(0.172)	(0.172)
Observations	3,552	3,552	3,552	5,920	5,920	5,920	4,736	4,736	4,736
F-statistic	38.12	38.05	38.97	66.58	66.39	67.50	52.32	52.02	53.08
Prob > F stat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.441	0.441	0.447	0.451	0.450	0.454	0.447	0.445	0.450

Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively. Robust standard errors are in parentheses.

Table 4: Impact of Dynamic Capabilities on Knowledge Management in the UK

	Before Crisis (2005-2007)			During Crisis (2008-2012)			Post Crisis (2013-2016)		
	BRICS	MINT	Common wealth	BRICS	MINT	Common wealth	BRICS	MINT	Common wealth
Dependent variable: log TFP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
log Intangible assets	0.0423***	0.0490***	0.0587***	0.0458***	0.0465***	0.0550***	0.0561***	0.0556***	0.0609***
	(0.00543)	(0.00484)	(0.00626)	(0.00410)	(0.00364)	(0.00472)	(0.00422)	(0.00373)	(0.00485)
Region	-0.0693	-0.154	0.0111	0.0799*	-0.410	0.00306	0.109**	-0.176	0.00436
	(0.0640)	(0.831)	(0.0569)	(0.0475)	(0.581)	(0.0426)	(0.0476)	(0.385)	(0.0432)
Region*Intangible assets	0.0212**	0.0542	-0.0183**	0.00145	0.0752	-0.0162***	-0.00176	0.0367	-0.0103*
	(0.00843)	(0.122)	(0.00773)	(0.00631)	(0.0879)	(0.00582)	(0.00646)	(0.0655)	(0.00603)
Firm size	0.0435***	0.0452***	0.0456***	0.0457***	0.0471***	0.0476***	0.0388***	0.0403***	0.0408***
	(0.00780)	(0.00782)	(0.00779)	(0.00590)	(0.00591)	(0.00589)	(0.00606)	(0.00607)	(0.00606)
Firm age	0.0891***	0.0872***	0.0849***	0.0835***	0.0825***	0.0793***	0.0859***	0.0857***	0.0831***
	(0.00879)	(0.00882)	(0.00879)	(0.00715)	(0.00718)	(0.00716)	(0.00918)	(0.00922)	(0.00922)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.067***	3.061***	3.027***	3.028***	3.057***	3.030***	3.027***	3.062***	3.045***
	(0.186)	(0.185)	(0.187)	(0.142)	(0.142)	(0.143)	(0.152)	(0.152)	(0.153)
Observations	3,864	3,864	3,864	6,440	6,440	6,440	5,152	5,152	5,152
F-statistic	15.77	15.54	15.97	24.15	23.85	24.48	21.27	20.94	21.15
Prob > F stat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.250	0.247	0.253	0.233	0.231	0.235	0.251	0.248	0.250

Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively. Robust standard errors are in parentheses.

Appendix

Definitions of variables

Variable name	Description	Mean	Standard Deviation
Sales	Total Operating Revenue (Net sales +Other operating revenue + Stock variations). These figures do not include VAT or excise taxes and similar obligatory payments. (Sales) is defined in the Balance Sheet account	93,421	743,793
Tangible Fixed Assets	All tangible fixed assets, such as building and machinery. The Tangible Fixed Assets are defined in the Balance Sheet account	22,071	226,451
Employees (also used to proxy firm size)	Total number of full time employees of the company (personnel)	265.51	1770.16
Material costs	The amount invested in the production of goods and services. It is financial item of the Profit & Loss account	74,636	453,459
Log of TFP	Log of Total Factor Productivity as the residual of production functions	4.21	0.93
Intangible Fixed Assets	All intangible assets such as formation expenses, research expenses, goodwill, development expenses and all other expenses with a long term effect. The Intangible Fixed Assets is a financial label of the Balance Sheet account	8,140	125,727
Firm age	Age of Firm since the year of incorporation	14.80	18.02
BRICS	Dummy equals 1 if the EMNE has its ultimate country of ownership in one of the BRICS countries, otherwise zero.	0.25	0.43
MINT	Dummy equals 1 if the EMNE has its ultimate country of ownership in one of the MINT countries, otherwise zero.	0.01	0.07
Eastern and Central Europe	Dummy equals 1 if the EMNE has its ultimate country of ownership in one of the Eastern and Central European countries, otherwise zero.	0.18	0.38
French colonies	Dummy equals 1 if the EMNE has its ultimate country of ownership in one of the former French colonial countries, otherwise zero.	0.05	0.21
Commonwealth	Dummy equals 1 if the EMNE has its ultimate country of ownership in one of the Commonwealth countries, otherwise zero.	0.33	0.47

Note: The monetary values for sales, tangible/intangible assets and material costs are all shows in millions of US dollars.

Correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1.Log TFP	1								
2.Log Intangibles	0.0771	1							
3.Firm size	0.1684	0.5596	1						
4.Firm age	0.1334	-0.0738	0.1542	1					
5.BRICS	0.0406	-0.0133	0.0659	0.0488	1				
6.MINT	0.0205	0.0102	0.0128	0.0251	-0.0423	1			
7.Eastern block	0.0237	-0.0736	-0.073	-0.0768	0.0134	-0.0199	1		
8.French colonies	-0.0926	-0.1402	-0.2536	-0.037	-0.1993	-0.0194	-0.0936	1	
9.Commonwealth	-0.0349	0.171	0.1351	-0.0294	0.0774	-0.0138	-0.21	-0.1113	1